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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/735,370	12/12/2003	John Frederick Ackerman	130013/11921 (21635-0116)	1818

31450 7590 09/13/2007

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ART UNIT	**PAPER NUMBER**
1762	
MAIL DATE	**DELIVERY MODE**
09/13/2007	PAPER

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

MAILED
SEP 1 3 2007
GROUP 1700

Application Number: 10/735,370
Filing Date: December 12, 2003
Appellant(s): ACKERMAN ET AL.

Shawn K. Leppo
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed July 18, 2007 appealing from the Office action mailed February 6, 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The following are the related appeals, interferences, and judicial proceedings known to the examiner which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal:

The previous decision on the first appeal in the case, dated August 24, 2006. Appellant has provided a copy of the Decision on Appeal with the July 18, 2007 Appeal Brief.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

WITHDRAWN REJECTIONS

The following grounds of rejection are not presented for review on appeal because they have been withdrawn by the examiner.

In the rejection of **Ground 2**, the rejection of claim 18 only has been withdrawn. The rejection of claims 13-17 and 19-21 remains in **Ground 2**. The Examiner notes that claim 18 remains rejected by the rejections in **Ground 1, Ground 3** and **Ground 6**.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,296,945	SUBRAMANIAN	10-2001
5,932,083	STOFFER ET AL	8-1999
2001/0003631	VILLIGER ET AL	6-2001
6,756,082	SUBRAMANIAN ET AL	6-2004
5,697,992	UEDA ET AL	12-1997

5,520,516	TAYLOR ET AL	5-1996
4,861,618	VINE ET AL	8-1989

Liu, Wei, et al, "Total Oxidation of Carbon Monoxide and Methane over Transition Metal-Fluorite Oxide Composite Catalysts", Journal of Catalysis 153, pages 304-316 (1995).

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Ground 1. Claims 13-21 stand finally rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

(A) Independent claim 13 has been amended December 13, 2006 to provide producing a primary ceramic coating "wherein the primary ceramic coating has an excess of oxygen vacancies therein." (see line 8 of the copy of claim 13 in the Appeal Brief of July 18, 2007, Appendix I). Appellant has not provided where support for this amendment is located. A review of the application as originally filed provides only that when yttria is used with zirconia an excess of oxygen vacancies results (see paragraphs [0012] and [0030] of the specification). Thus, the use of a primary ceramic with an excess of oxygen vacancies is only supported as filed for when the coating is the species

of yttria used with zirconia, such as in claim 17 (dependent on claim 13), not for the genus of every possible ceramic with oxygen vacancies. As discussed in MPEP 2163.05:

> The written description requirement for a claimed genus may be satisfied through sufficient description of a representative number of species. A "representative number of species" means that the species which are adequately described are representative of the entire genus. Thus, when there is substantial variation within the genus, one must describe a sufficient variety of species to reflect the variation within the genus. >The disclosure of only one species encompassed within a genus adequately describes a claim directed to that genus only if the disclosure "indicates that the patentee has invented species sufficient to constitute the gen[us]." See Enzo Biochem, 323 F.3d at 966, 63 USPQ2d at 1615.

Here, the disclosure only describes a single species (the use of yttria used with zirconia) as providing oxygen vacancies, and ceramics in general include many possible materials, from various oxides, silicides, borides, carbides, etc. One of ordinary skill in the art would therefore expect substantial variation from the species and have to determine which have oxygen vacancies and if the problem is solved using the cerium oxide as claimed. Thus, the one species disclosed would not indicate "that the patentee has invented species sufficient to constitute the gen[us]." As a result, the claim contains new matter.

(B) Independent claim 13 has also been amended December 13, 2006 to delete the previous requirement that cerium oxide with cerium in the +4 oxidation state is used and instead requires that "cerium in an oxidation state that removes oxygen vacancies from the primary ceramic coating" is used (see lines 10-11 of the copy of claim 13 in the Appeal Brief of July 18, 2007, Appendix I). Appellant has not provided where support

for this amendment is located. A review of the application as originally filed provides only that cerium in the +4 oxidation state is always described as being used (see paragraphs [0007], [0012] and [0029] of the specification), and while cerium in this +4 oxidation state is described as removing oxygen vacancies from zirconia with yttria added (see paragraphs [0012] and [0030] of the specification), the claim as now worded allows for other oxidation states of cerium to be used (such as +3) and to remove vacancies from any primary ceramic coating with oxygen vacancies. Therefore, the claim is broadened beyond what was originally supported by the application as filed. As a result, the claim contains new matter.

(C) Independent claim 19 has been newly provided in the amendment of December 13, 2006 and requires producing a primary ceramic coating "wherein the primary ceramic coating has an excess of oxygen vacancies therein" (see lines 6-7 of the copy of claim 19 in the Appeal Brief of July 18, 2007, Appendix I). Appellant has not provided where support for this amendment is located. A review of the application as originally filed provides only that when yttria is used with zirconia an excess of oxygen vacancies results (see paragraphs [0012] and [0030] of the specification). Thus, the use of a primary ceramic with an excess of oxygen vacancies is only supported as filed for when the coating is the species of yttria used with zirconia, such as in claim 20 (dependent on claim 19), not for the genus of every possible ceramic with oxygen vacancies. As discussed in MPEP 2163.05:

> The written description requirement for a claimed genus may be satisfied through sufficient description of a representative number of species. A "representative number of species" means that the species which are adequately described are representative of the entire genus. Thus, when there is substantial variation within the genus, one must describe a sufficient variety of species to reflect the variation within the genus. >The disclosure of only one species encompassed within a genus adequately describes a claim directed to that genus only if the disclosure "indicates that the patentee has invented species sufficient to constitute the gen[us]." See Enzo Biochem, 323 F.3d at 966, 63 USPQ2d at 1615.

Here, the disclosure only describes a single species (the use of yttria used with zirconia) as providing oxygen vacancies, and ceramics in general include many possible materials, from various oxides, silicides, borides, carbides, etc. One of ordinary skill in the art would therefore expect substantial variation from the species and have to determine which have oxygen vacancies and if the problem is solved using the cerium oxide as claimed. Thus, the one species disclosed would not indicate "that the patentee has invented species sufficient to constitute the gen[us]." As a result, the claim contains new matter.

(D) New independent claim 19 also requires providing that "a sintering-inhibitor region at a surface of the primary ceramic coating, wherein the sintering inhibiting region removes oxygen vacancies from the primary ceramic coating" (see lines 8-10 of the copy of claim 19 in the Appeal Brief of July 18, 2007, Appendix I) is used. Appellant has not provided where support for this amendment is located. A review of the application as originally filed provides only that cerium in the +4 oxidation state is always described as being used (see paragraphs [0007], [0012] and [0029] of the

specification), and while cerium in this +4 oxidation state is described as removing oxygen vacancies from zirconia with yttria added (see paragraphs [0012] and [0030] of the specification), the claim as now worded allows for other oxidation states of cerium to be used (such as +3) and to remove vacancies from any primary ceramic coating with oxygen vacancies. As well, the claim does not require the sintering-inhibitor region to be provided by cerium oxide at all, and therefore entirely different materials from cerium oxide can be used. Therefore, the claim is broadened beyond what was originally supported by the application as filed. As a result, the claim contains new matter.

The other dependent claims do not cure all the defects of these claims from which they depend.

Ground 2. Claims 13-17 and 19-21 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian (US 6296945) in view of Stoffer et al (US 5932083).

Claims 13, 19: Subramanian teaches a method for preparing a protected article. *Column 2, lines 20-40.* The article is provided. *Column 3, lines 50-68.* A bond coat is deposited onto an exposed surface of the article. *Column 4, lines 5-20 and figure 2.* A thermal barrier coating is formed on an exposed surface of the bond coat. *Column 4, lines 50-65 and figure 2.* To form the thermal barrier coating, first a primary ceramic coating is applied to an exposed surface of the bond coat. *Column 2, lines 25-45 (the*

"base" or "primary" ceramic is preferably yttria stabilized zirconia, for example). The surface of the primary coating comprises columnar grains with facing surfaces. *See figures 2-3 and column 4, lines 55-60.* This primary ceramic coating would have an excess of oxygen vacancies as the use of yttria stabilized zirconia is taught, which inherently has an excess of the oxygen vacancies. *Column 2, lines 40-45.* Then a sintering inhibiting material is applied to the surface of the primary ceramic coating. *Column 2, lines 25-45, column 5, lines 30-65 and figures 2-3 (the sheath material).* The sintering inhibiting region can comprise cerium oxide in a concentration greater than a general cerium oxide concentration in the primary ceramic coating. *Column 2, line 65 through column 3, line 10 and column 5, lines 30-50 (cerium (Ce) can be provided as component C of the sheath material, thus providing Ce_zO_w, and furthermore, C is desirably not the A or B material of the primary ceramic (A = zirconia and B=yttria if yttria stabilized zirconia is used as the primary ceramic, for example)).* The resulting applied material can be a stable oxide of C_zO_w, where C=Ce. *Column 2, lines 35-40, column 4, lines 55-65 and column 5, lines 35-45.* After the sintering inhibiting region is applied, there remain air filled gaps between the facing surfaces of the columnar grains. *Figures 2-3 and column 5, lines 10-30.*

Claim 14: the article is a nickel base superalloy article. *Column 3, lines 50-68.*

Claim 15: the article is in the form of a component for a gas turbine engine. *Column 3, lines 50-68.*

Claim 16: the step of depositing the bond coat includes depositing an aluminum containing overlay bond coat. *Column 4, lines 5-20.*

Claim 17, 20: the primary ceramic coating can be yttria stabilized zirconia. *Column 2, lines 40-50.*

Subramanian can be considered as teaching all the features of these claims except that the selected stable oxide of cerium is such that a +4 oxidation state of cerium is used and provides that the applied cerium oxide or sintering inhibitor region removes oxygen vacancies.

However, Stoffer indicates that cerium possesses two highly stable oxides, CeO_2 or Ce_2O_3, in the oxidation states of 3 and 4. *See column 2, lines 45-55.*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Subramanian to select CeO_2 as the stable oxide of cerium to be used as suggested by Stoffer in order to provide a desirable sheath coating of cerium oxide, because Subramanian teaches to use a stable oxide of cerium as the coating material, and Stoffer teaches that a well known highly stable oxide of cerium is CeO_2, which would have cerium in a +4 oxidation state (as oxygen has a +2 valence state). The use of CeO_2 would provide that the applied cerium oxide/sintering inhibitor region would inherently remove oxygen vacancies from the primary ceramic coating, because CeO_2 is a material that inherently provides such removal from yttria stabilized zirconia. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Ground 3. Claims 1-5, 7, 9 and 13-21 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Villiger et al (US 2001/003631) in view of Subramanian et al (US 6756082) (hereinafter Subramanian '082) and Liu, et al "Total Oxidation of Carbon Monoxide and Methane over Transition Metal-Fluorite Oxide Composite Catalysts" Article (hereinafter Liu Article).

Claims 1, 7, 9, 13, 19: Villiger teaches a method for preparing a protected article. *Paragraphs [0001]-[0003].* The article is provided. *Paragraph [0014] (component 1).* A coating is formed on the component. *Paragraph [0014] (coating 10).* The coating can be a thermal barrier coating. *Paragraph [0002] (with the function of increased temperature in use through thermal protective layers).* To form the thermal barrier coating, first a primary ceramic coating is applied by thermal spraying, for example. *Paragraph [0017] (the base coating 10 ceramic can be yttria and zirconia, for example).* This primary ceramic coating would have an excess of oxygen vacancies as the use of yttria with zirconia is taught, which inherently has an excess of the oxygen vacancies. *Paragraph [0017].* Then, a sealing medium 2, which is an aqueous or organic solution containing a salt of an oxidizable metal in solution is applied to the exposed surface 11 of the coating 10. *Paragraphs [0014], [0019], [0025] and [0027].* The solution can contain a cerium oxide precursor such as cerium acetate (Ce $(C_2H_3O_2)_3.3/2H_2O$), which is not "cerium oxide with cerium in the +4 oxidation state". *Paragraph [0027].* The solution infiltrates the coating 10 from the exposed surface 11. *Paragraph [0019].* The applied solution is then

heated to form the oxide of the metal salt by means of oxygen from the surroundings or from oxidizing agents in the solution. *Paragraph [0020].* This would form cerium oxide in the case of cerium acetate. This would produce a sintering inhibitor region on the surface of the primary ceramic coating as cerium oxide is impregnated within the surface and on top of the ceramic coating 10. Furthermore, Villiger teaches that closed and large pores cannot be sealed off with the coating, thus indicating that although coating would be impregnated into the large pores, they would not be entirely closed off (i.e. partially filed), leaving air filled gaps in the pores between facing surfaces of the pores, and also indicating that the thermally sprayed primary ceramic coating would conventionally be known to have large pores that cannot be sealed off and small pores that can as earlier described in the document. *Paragraph [0032] and claims 6 and 7..* Villiger also indicates that coating containing relatively large pores can still be beneficially treated by the sealing process to "be used as a thermal protective layer with reduced thermal conductivity but with higher corrosion resistance." *Paragraph [0032] and claims 6 and 7.*

Claims 3, 15: the article is in the form of a component for a gas turbine engine. *Paragraph [0037] (the blade for the gas turbine).*

Claim 5, 17: the primary ceramic coating can be yttria stabilized zirconia. *Paragraphs [0017] and [0034] (the combination of yttria and zirconia provides yttria stabilized zirconia).*

Villiger teaches all the features of these claims except (1) that a bond coating is used under the primary ceramic coating (claims 1, 9, 13), (2) that the formed cerium oxide has cerium in the +4 oxidation state and removes oxygen vacancies, (3) that the substrate is a nickel base superalloy (claims 2, 14), (4) the step of depositing the bond coat includes depositing an aluminum containing overlay bond coat (claims 4, 16), and (5) that the primary ceramic coating comprise columnar grains with facing surfaces on which the cerium oxide precursor is deposited to form sintering inhibiting regions (claims 1, 13) or is columnar (claim 9).

However, Subramanian '082 teaches that when applying thermal barrier layers to gas turbine components, it is well known to provide an aluminum containing overlay bond coating applied by plasma spraying before applying the ceramic thermal barrier coating by the thermal spray method of plasma spraying. *Column 5, lines 45-65 and column 1, lines 15-35.* Furthermore, the substrate of such gas turbine components is well known to be nickel based superalloys. *Column 5, lines 15-30.* As well, the ceramic thermal barrier coating is zirconia stabilized with about 8 wt% yttria, for example. *Column 5, lines 60-65.* Subramanian '082 teaches that this ceramic thermal barrier coating applied by plasma spray or other methods is desirably in the form of a columnar microstructure. *Column 4, lines 55-65 and figure 3.* This provides a surface comprising columnar grains having facing surfaces. *Figure 3.* Moreover, a sintering inhibiting material is deposited onto the facing surfaces and partially filling the gaps but leaving air filled gaps between the facing surfaces. *Figure 3 and column 6, lines 5-20.*

Moreover, Liu Article teaches that cerium acetate when heated in air provides cerium oxide. *Page 305, section 2.1 ("Cerium acetate (99.9%, Aldrich), heated for 4 h at 750°C in air, was used as the primary precursor of La-free cerium oxide.").* This cerium oxide is described as being CeO_2. *Page 305, section 2.1 ("The physical mixture of ceria and copper oxide, CuO + CeO_2, was prepared by blending the CuO and CeO_2 powders with water . . .", indicating that the formed cerium oxide (ceria) from the cerium acetate is CeO_2).*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Villiger to use a gas turbine component with a nickel base superalloy substrate and to provide an aluminum containing overlay bond coating applied by plasma spraying before applying the thermally sprayed ceramic thermal barrier coating as suggested by Subramanian '082 with an expectation of providing a desirably protected thermal barrier coating made up of desirable components, because Villiger teaches partially sealing a thermal sprayed ceramic thermal barrier coating on a gas turbine component, and Subramanian '082 teaches that when providing a thermal sprayed ceramic thermal barrier coating on a gas turbine component, it is well known to provide that the component is a nickel base superalloy and that a plasma sprayed aluminum containing overlay bond coating is provided on the component before applying the ceramic thermal barrier coating. Furthermore, it would further have been obvious to modify Villiger to provide that the ceramic thermal barrier coating is in the form of columnar grains with facing surfaces and that the coating acting as a sintering inhibitor material partially fills the pores or gaps between the columns as suggested by

Subramanian '082 with an expectation of providing a desirably protective thermal barrier coating, because Villiger teaches that the thermal barrier coating material can be zirconia with yttria at, for example, 8% yttria and that the pores can be partially filled with a material that would be sintering inhibiting, and Subramanian '082 teaches that a desirable zirconia thermal barrier coating includes zirconia stabilized with 8% yttria and applied as columnar grains with facing surfaces and with an applied sintering inhibiting material that partially fills the pores of gaps between the columns. It would further have been obvious to modify the process of Villiger in view of Subramanian '082 to select a precursor that provides CeO_2 as the formed oxide, which would provide that the cerium oxide precursor is such that the resulting cerium oxide has cerium in the +4 valence state as suggested by Liu Article with an expectation of desirable protective sealing results, because Villiger teaches to oxidize cerium acetate and to oxidize using oxygen from the surroundings and Liu Article teaches that it is well known that when cerium acetate is oxidized to provide cerium oxide, CeO_2 is formed, which would have cerium in a +4 oxidation state (as oxygen has a +2 valence state), and thus Villiger teaches that a cerium oxide precursor that results in cerium oxide with cerium in the +4 valence state can be desirably used. The use of CeO_2 would provide that the applied cerium oxide/sintering inhibitor region would inherently remove oxygen vacancies from the primary ceramic coating, because CeO_2 is a material that inherently provides such removal from yttria stabilized zirconia. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the

prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Ground 4. Claims 6 and 11 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Villiger in view of Subramanian '082 and Liu Article as applied to claims 1-5, 7, 9 and 13-21 above, and further in view of Ueda et al (US 5697992).

Villiger in view of Subramanian '082 and Liu Article teaches all the features of these claims except using ammonium cerium sulfate as the precursor. Villiger does teach that salts of the oxidizable metal can be used as the precursors, and describes cerium nitrate and cerium acetate as possible precursors. *Paragraphs [0027] and [0027].*

Ueda teaches that cerium oxide can be provided by providing a precursor of the oxide in liquid, and that a well known cerium compound precursor for this purpose that converts to cerium oxide by calcining is ammonium cerium sulfate (i.e., $(NH_4)Ce(SO_4)_3$). *See column 4, lines 20-30.* The calcining provides heating to perform the conversion. *Column 4, lines 20-30 and 40-50.* Heating methods include vacuum and non vacuum heating devices (which would provide heating in air). *See column 4, lines 60-68.* Ueda also teaches that cerium nitrates and cerium acetates are also known precursors for converting to metal oxides. Column 4, lines 20-30.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Villiger in view of Subramanian '082and Liu Article to use ammonium cerium sulfate as a precursor for cerium oxide as suggested by Ueda

with an expectation of desirable formation of cerium oxide because Villiger in view of Subramanian '082 and Liu Article teaches that salts of the oxidizable metal can be used as the precursors, and describes cerium nitrate and cerium acetate as possible precursors and Ueda teaches that cerium acetate, cerium nitrates and ammonium cerium sulfate would all be known acceptable precursors for making cerium oxide by heating.

Ground 5. Claim 10 stands finally rejected under 35 U.S.C. 103(a) as being unpatentable over Villiger in view of Subramanian '082 and Liu Article as applied to claims 1-5, 7, 9 and 13-21 above, and further in view of Taylor et al (US 5520516).

Villiger in view of Subramanian '082 and Liu Article teaches all the features of this claim except using 7 percent zirconia by weight in the primary ceramic coating.

Taylor teaches that when forming a vertically cracked, or columnar, thermal barrier coating of zirconia on a gas turbine engine component by plasma spraying, it is well known to use about 7 to 8 weight percent yttria stabilized zirconia. *Column 5, lines 5-40 and column 1, lines 5-15.*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Villiger in view of Subramanian '082 and Liu Article to use 7 weight percent zirconia as suggested by Taylor with an expectation of providing a desirable primary yttria stabilized zirconia coating because Villiger in view of Subramanian '082 and Liu Article teaches that the thermal barrier coating material can

be zirconia with yttria, at for example 8% yttria (se Villiger and Subramanian '082), and Taylor teaches that desirable zirconia thermal barrier coating material includes about 7 to 8 wt% yttria.

Ground 6. Claims 1-5, 7, 9, 10 and 13-21 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Villiger et al (US 2001/003631) in view of Taylor et al (US 5520516) and Liu, et al "Total Oxidation of Carbon Monoxide and Methane over Transition Metal-Fluorite Oxide Composite Catalysts" Article (hereinafter Liu Article).

Claims 1, 7, 9, 13, 19: Villiger teaches a method for preparing a protected article. *Paragraphs [0001]-[0003].* The article is provided. *Paragraph [0014] (component 1).* A coating is formed on the component. *Paragraph [0014] (coating 10).* The coating can be a thermal barrier coating. *Paragraph [0002] (with the function of increased temperature in use through thermal protective layers).* To form the thermal barrier coating, first a primary ceramic coating is applied by thermal spraying, for example. *Paragraph [0017] (the base coating 10 ceramic can be yttria and zirconia, for example).* This primary ceramic coating would have an excess of oxygen vacancies as the use of yttria with zirconia is taught, which inherently has an excess of the oxygen vacancies. *Paragraph [0017].* Then, a sealing medium 2, which is an aqueous or organic solution containing a salt of an oxidizable metal in solution is applied to the exposed surface 11 of the coating 10. *Paragraphs [0014], [0019], [0025] and [0027].* The solution can contain a cerium oxide

precursor such as cerium acetate (Ce $(C_2H_3O_2)_3.3/2H_2O$), which is not "cerium oxide with cerium in the +4 oxidation state". *Paragraph [0027].* The solution infiltrates the coating 10 from the exposed surface 11. *Paragraph [0019].* The applied solution is then heated to form the oxide of the metal salt by means of oxygen from the surroundings or from oxidizing agents in the solution. *Paragraph [0020].* This would form cerium oxide in the case of cerium acetate. This would produce a sintering inhibitor region on the surface of the primary ceramic coating as cerium oxide is impregnated within the surface and on top of the ceramic coating 10. Furthermore, Villiger teaches that closed and large pores cannot be sealed off with the coating, thus indicating that although coating would be impregnated into the large pores, they would not be entirely closed off (i.e. partially filed), leaving air filled gaps in the pores between facing surfaces of the pores, and also indicating that the thermally sprayed primary ceramic coating would conventionally be known to have large pores that cannot be sealed off and small pores that can as earlier described in the document. *Paragraph [0032] and claims 6 and 7..* Villiger also indicates that coating containing relatively large pores can still be beneficially treated by the sealing process to "be used as a thermal protective layer with reduced thermal conductivity but with higher corrosion resistance." *Paragraph [0032] and claims 6 and 7.*

Claims 3, 15: the article is in the form of a component for a gas turbine engine. *Paragraph [0037] (the blade for the gas turbine).*

Claim 5, 17: the primary ceramic coating can be yttria stabilized zirconia. *Paragraphs [0017] and [0034] (the combination of yttria and zirconia provides yttria stabilized zirconia).*

Villiger teaches all the features of these claims except (1) that a bond coating is used under the primary ceramic coating (claims 1, 9, 13), (2) that the formed cerium oxide has cerium in the +4 oxidation state and removes oxygen vacancies, (3) that the substrate is a nickel base superalloy (claims 2, 14), (4) the step of depositing the bond coat includes depositing an aluminum containing overlay bond coat (claims 4, 16), (5) that the yttria stabilized zirconia is 7 percent yttria by weight (claim 10) and (6) that the primary ceramic coating comprise columnar grains with facing surfaces on which the cerium oxide precursor is deposited to form sintering inhibiting regions (claims 1, 13) or is columnar (claim 9).

However, Taylor teaches that when forming a vertically cracked, or columnar, thermal barrier coating of zirconia on a gas turbine engine component by plasma spraying, it is well known to use about 7 to 8 weight percent yttria stabilized zirconia. *Column 5, lines 5-40 and column 1, lines 5-15.* Furthermore, Taylor teaches that it is well known to provide an aluminum containing overlayer bond coating by plasma sprayng under the zirconia coating. *Column 5, lines 25-40.* Furthermore, the substrate can be a superalloy, and can be a nickel base alloy. *Column 5, lines 25-40.*

Moreover, Liu Article teaches that cerium acetate when heated in air provides cerium oxide. *Page 305, section 2.1 ("Cerium acetate (99.9%, Aldrich), heated for 4 h at 750°C*

in air, was used as the primary precursor of La-free cerium oxide."). This cerium oxide is described as being CeO_2. *Page 305, section 2.1 ("The physical mixture of ceria and copper oxide, CuO + CeO_2, was prepared by blending the CuO and CeO_2 powders with water . . .", indicating that the formed cerium oxide(ceria) from the cerium acetate is CeO_2).*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Villiger to use a gas turbine component with a nickel base superalloy substrate and to provide an aluminum containing overlay bond coating applied by plasma spraying before applying the thermally sprayed ceramic thermal barrier coating as suggested by Taylor with an expectation of providing a desirably protected thermal barrier coating made up of desirable components, because Villiger teaches partially sealing a thermal sprayed ceramic thermal barrier coating on a gas turbine component, and Taylor teaches that when providing a thermal sprayed ceramic thermal barrier coating on a gas turbine component, it is well known to provide that the component is a nickel base and superalloy and that a plasma sprayed aluminum containing overlay bond coating is provided on the component before applying the ceramic thermal barrier coating. It would further have been obvious to to modify Villiger to use 7 weight percent zirconia as suggested by Taylor with an expectation of providing a desirable primary yttria stabilized zirconia coating because Villiger teaches that the thermal barrier coating material can be zirconia with yttria, at for example 8% yttria, and Taylor teaches that desirable zirconia thermal barrier coating material includes about 7 to 8 wt% yttria. Furthermore, it would further have been obvious to

modify Villiger to provide that the ceramic thermal barrier coating is in the form of columnar grains with facing surfaces and that the coating acting as a sintering inhibitor material partially fills the pores or gaps between the columns as suggested by Taylor with an expectation of providing a desirably protective thermal barrier coating, because Villiger teaches that the thermal barrier coating material can be zirconia with yttria at, for example, 8% yttria and that the pores can be partially filled with a material that would be sintering inhibiting, and Taylor teaches that a desirable zirconia thermal barrier coating includes zirconia stabilized with 7-8% yttria and applied as columnar grains (vertical macrocracks) which would have facing surfaces forming pores. It would further have been obvious to modify the process of Villiger in view of Taylor to select a precursor that provides CeO_2 as the formed oxide, which would provide that the cerium oxide precursor is such that the resulting cerium oxide has cerium in the +4 valence state as suggested by Liu Article with an expectation of desirable protective sealing results, because Villiger teaches to oxidize cerium acetate and to oxidize using oxygen from the surroundings and Liu Article teaches that it is well known that when cerium acetate is oxidized to provide cerium oxide, CeO_2 is formed, which would have cerium in a +4 oxidation state (as oxygen has a +2 valence state), and thus Villiger teaches that a cerium oxide precursor that results in cerium oxide with cerium in the +4 valence state can be desirably used. The use of CeO_2 would provide that the applied cerium oxide/sintering inhibitor region would inherently remove oxygen vacancies from the primary ceramic coating, because CeO_2 is a material that inherently provides

such removal from yttria stabilized zirconia. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya,* 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Ground 7. Claims 6 and 11 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Villiger in view of Taylor and Liu Article as applied to claims 1-5, 7, 9, 10 and 13-21 above, and further in view of Ueda et al (US 5697992).

Villiger in view of Taylor and Liu Article teaches all the features of these claims except using ammonium cerium sulfate as the precursor. Villiger does teach that salts of the oxidizable metal can be used as the precursors, and describes cerium nitrate and cerium acetate as possible precursors. *Paragraphs [0027] and [0027].*

Ueda teaches that cerium oxide can be provided by providing a precursor of the oxide in liquid, and that a well known cerium compound precursor for this purpose that converts to cerium oxide by calcining is ammonium cerium sulfate (i.e., $(NH_4)Ce(SO_4)_3$). *See column 4, lines 20-30.* The calcining provides heating to perform the conversion. *Column 4, lines 20-30 and 40-50.* Heating methods include vacuum and non vacuum heating devices (which would provide heating in air). *See column 4, lines 60-68.* Ueda also teaches that cerium nitrates and cerium acetates are also known precursors for converting to metal oxides. Column 4, lines 20-30.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Villiger in view of Taylor and Liu Article to use ammonium cerium sulfate as a precursor for cerium oxide as suggested by Ueda with an expectation of desirable formation of cerium oxide because Villiger in view of Taylor and Liu Article teaches that salts of the oxidizable metal can be used as the precursors, and describes cerium nitrate and cerium acetate as possible precursors and Ueda teaches that cerium acetate, cerium nitrates and ammonium cerium sulfate would all be known acceptable precursors for making cerium oxide by heating.

Ground 8. Claims 19-21 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Villiger et al (US 2001/003631) in view of Vine et al (US 4861618) and Liu, et al "Total Oxidation of Carbon Monoxide and Methane over Transition Metal-Fluorite Oxide Composite Catalysts" Article (hereinafter Liu Article).

Claim 19: Villiger teaches a method for preparing a protected article. *Paragraphs [0001]-[0003].* The article is provided. *Paragraph [0014] (component 1).* A coating is formed on the component. *Paragraph [0014] (coating 10).* The coating can be a thermal barrier coating. *Paragraph [0002] (with the function of increased temperature in use through thermal protective layers).* To form the thermal barrier coating, first a primary ceramic coating is applied by thermal spraying, for example. *Paragraph [0017] (the base coating 10 ceramic can be yttria and zirconia, for example).* This primary ceramic coating would have an excess of oxygen vacancies as the use of yttria with zirconia is taught, which

inherently has an excess of the oxygen vacancies. *Paragraph [0017].* Then, a sealing medium 2, which is an aqueous or organic solution containing a salt of an oxidizable metal in solution is applied to the exposed surface 11 of the coating 10. *Paragraphs [0014], [0019], [0025] and [0027].* The solution can contain a cerium oxide precursor such as cerium acetate (Ce $(C_2H_3O_2)_3.3/2H_2O$), which is not "cerium oxide with cerium in the +4 oxidation state". *Paragraph [0027].* The solution infiltrates the coating 10 from the exposed surface 11. *Paragraph [0019].* The applied solution is then heated to form the oxide of the metal salt by means of oxygen from the surroundings or from oxidizing agents in the solution. *Paragraph [0020].* This would form cerium oxide in the case of cerium acetate. This would produce a sintering inhibitor region on the surface of the primary ceramic coating as cerium oxide is impregnated within the surface and on top of the ceramic coating 10.

Claim 20: the primary ceramic coating can be yttria stabilized zirconia. Paragraphs [0017] and [0034] (the combination of yttria and zirconia provides yttria stabilized zirconia).

Villiger teaches all the features of these claims except (1) that a bond coating is used under the primary ceramic coating (claim 19), (2) that the formed cerium oxide has cerium in the +4 oxidation state and removes oxygen vacancies.

However, Vine teaches that when applying thermal barrier layers to gas turbine components, it is well known to provide an aluminum containing overlay bond coating applied by plasma spraying before applying the ceramic thermal barrier coating by the

thermal spray method of plasma spraying. *Column 2, lines 25-45 and column 1, lines 5-30.* Vine teaches that the bond coat helps provide beneficial performance of the thermal barrier coating. *Column 4, lines 55-65.* Furthermore, the substrate of such gas turbine components is well known to be nickel based superalloys. *Column 1, lines 20-35.* As well, the ceramic thermal barrier coating is zirconia stabilized with 6-8 wt% yttria, desirably 7 % yttria. *Column 6, lines 5-10 and 25-35 and column 2, lines 35-45.*

Moreover, Liu Article teaches that cerium acetate when heated in air provides cerium oxide. *Page 305, section 2.1 ("Cerium acetate (99.9%, Aldrich), heated for 4 h at 750°C in air, was used as the primary precursor of La-free cerium oxide.").* This cerium oxide is described as being CeO_2. *Page 305, section 2.1 ("The physical mixture of ceria and copper oxide, CuO + CeO_2, was prepared by blending the CuO and CeO_2 powders with water . . .", indicating that the formed cerium oxide (ceria) from the cerium acetate is CeO_2).*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Villiger to provide a bond coating applied by plasma spraying before applying the thermally sprayed ceramic thermal barrier coating as suggested by Vine with an expectation of providing a desirably protected thermal barrier coating made up of desirable components, because Villiger teaches sealing a thermal sprayed ceramic thermal barrier coating on a gas turbine component, and Vine teaches that when providing a thermal sprayed ceramic thermal barrier coating on a gas turbine component, it is well known to provide that a plasma sprayed bond coating is provided on the component before applying the ceramic thermal barrier coating and

helps coating performance. It would further have been obvious to modify the process of Villiger in view of Vine to select a precursor that provides CeO_2 as the formed oxide, which would provide that the cerium oxide precursor is such that the resulting cerium oxide has cerium in the +4 valence state as suggested by Liu Article with an expectation of desirable protective sealing results, because Villiger teaches to oxidize cerium acetate and to oxidize using oxygen from the surroundings and Liu Article teaches that it is well known that when cerium acetate is oxidized to provide cerium oxide, CeO_2 is formed, which would have cerium in a +4 oxidation state (as oxygen has a +2 valence state), and thus Villiger teaches that a cerium oxide precursor that results in cerium oxide with cerium in the +4 valence state can be desirably used. The use of CeO_2 would provide that the applied cerium oxide/sintering inhibitor region would inherently remove oxygen vacancies from the primary ceramic coating, because CeO_2 is a material that inherently provides such removal from yttria stabilized zirconia. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

(10) Response to Argument

The Examiner notes that appellant, at pages 5-6 of the Appeal Brief of July 18, 2007, first provides a description of the present invention, noting the preferred treatment of yttria stabilized zirconia (YSZ) with cerium oxide in the +4 valence state.

Ground 1. The Rejection of Claims 13-21 under 35 USC 112, first paragraph.

Appellant first argues this rejection at pages 6-7 of the Appeal Brief of July 18, 2007, providing a citation from claim 13 and arguing that claim 13 "thus recites that where the primary ceramic coating an excess of oxygen vacancies therein, cerium is provided in an oxidation state that removes oxygen vacancies from the primary ceramic coating" (page 7 of the Appeal Brief). Appellant further argues that the recited approach is disclosed at paragraphs [0012] and [0030] of the specification, citing paragraph [0012] as disclosing the limitation in the context of a preferred embodiment. According to appellant, the person of ordinary skill is placed in possession of the recited invention by this disclosure, and understands that cerium oxide in the proper oxidation state acts to eliminate excess vacancies from the ceramic having such excess vacancies. According to appellant, the rejection seeks to limit the claimed invention to the preferred embodiment and there is no basis for such a narrowing. The Examiner has reviewed these arguments, however, the Examiner maintains the rejection. As to claim 13, the Examiner has provided new matter rejections as to the use of "wherein the primary ceramic coating has an excess of oxygen vacancies therein" (rather than specifically claiming the use of yttria with zirconia as the primary ceramic coating with such vacancies) and as to the use of "cerium in an oxidation state that removes oxygen

vacancies from the primary ceramic coating" rather than the previous requirement that cerium in the +4 oxidation state is used. While appellant argues that paragraph [0012] and presumably paragraphs [0030] of the specification, which specifically describe the use of yttria with zirconia as the primary ceramic coating with an excess of oxygen vacancies and the use of cerium in the +4 valance state, is "in the context of a preferred embodiment", and that one of ordinary skill understands the general teaching that that cerium oxide in the proper oxidation state acts to eliminate excess vacancies from the ceramic having such excess vacancies, the Examiner disagrees. Paragraphs [0012] and [0030] are the <u>only</u> disclosure in the application as filed of ceramics having an excess of oxygen vacancies, and it is <u>only</u> described in regards to occurring when yttria is added to zirconia. Therefore as to the 35 USC 112, first paragraph rejection of claim 13 described as part (A) in the ***Grounds of Rejection*** above, there is no support for the general use of "wherein the primary ceramic coating has an excess of oxygen vacancies therein". This also applies to the 35 USC 112, first paragraph rejection of claim 19 described as part (C) in the ***Grounds of Rejection*** above, which as the same rejection (although appellant has not specifically mentioned claim 19). As to the use of "cerium in an oxidation state that removes oxygen vacancies from the primary ceramic coating" rather than the previous requirement that cerium in the +4 oxidation state is used (which corresponds to the 35 USC 112, first paragraph rejection of claim 13 described as part (B) in the ***Grounds of Rejection*** above), appellant's citation of paragraph [0012] only points out that cerium in the +4 valence state is required by the disclosure as

originally filed. As discussed in the ***Grounds of Rejection above***, cerium in the +4 valence state is always described as being used in the disclosure as originally filed. The wording as now used allows cerium in other oxidation states to be used, such as +3. The Examiner notes that it is well established from the art in the case (see Stoffer et al (US 5932083)) that cerium oxides can be provided with cerium in the +3 or +4 valence state. Therefore, there is no support in the disclosure as filed for the general use of cerium in an oxidation state that removes oxygen vacancies from the primary ceramic coating. Although appellant has not specifically mentioned claim 19, the Examiner notes that there would be even less support for claim 19's "a sintering-inhibitor region at a surface of the primary ceramic coating, wherein the sintering inhibiting region removes oxygen vacancies from the primary ceramic coating" (which corresponds to the 35 USC 112, first paragraph rejection of claim 19 described as part (D) in the ***Grounds of Rejection*** above), because not only can cerium oxide with cerium in the +3 or +4 valence state be used as discussed previously, the claim as worded does not even require cerium oxide to be used, and the disclosure as filed provides no discussion at all of a material other than cerium oxide being used as the sintering-inhibitor region.

Appellant further states, at page 8 of the Appeal Brief, that the "Examiner argues that the recitation of claim 13 allows for other oxidation states of the cerium to be used, such as the +3 oxidation state Applicant is not aware that the +3 oxidation state of cerium is "an oxidation state that removes oxygen vacancies from the primary ceramic coating", and the Examiner has not provided any basis for asserting that a person of

ordinary skill in the art will know that cerium in the +3 oxidation state will have that effect." (page 8 of the Appeal Brief). The Examiner disagrees with appellant's position. This discussion corresponds to the 35 USC 112, first paragraph rejection of claim 13 described as part (B) in the Grounds of Rejection above. As discussed above, is well established from the art in the case (see Stoffer et al (US 5932083)) that cerium oxides can be provided with cerium in the +3 or +4 valence state, but the disclosure as originally filed only provides for the specific use of cerium in the +4 valence state. Appellant's broadening of the language to now encompass more than the +4 valence state is new matter. While appellant argues that they are not aware that the +3 oxidation state of cerium is "an oxidation state that removes oxygen vacancies from the primary ceramic coating", the fact remains that their claim language encompasses such use.

Ground 2. The rejection of claims 13-17 and 19-21 under 35 USC 103 over Subramanian (US 6296945) in view of Stoffer (US 5932083)

The Examiner first notes that this rejection corresponds to the rejection affirmed by the Board in the Board decision of August 24, 2006. Appellant has provided a first discussion of case law as to an objective basis for modifying or combination the teachings of the references at pages 8-10 of the Appeal Brief of July 18, 2007 and further argues that in the present case, there is set forth no objective basis for combining the teachings of the references in the manner used by this rejection, stating that "In this

case, Subramanian teaches applying a yttria-stabilized zirconia thermal barrier coating to nickel-base superalloys. Stoffer teaches applying cerium-based corrosion-protection layers to aluminum alloys. There is nothing in Subramanian that suggests that a cerium-based corrosion-protection layer, that is otherwise applied to aluminum alloys, would be applied to a yttria-stabilized thermal barrier coating." (page 10 of the Appeal Brief). The Examiner has reviewed these arguments, however, the Examiner disagrees. Stoffer has been provided as a teaching reference as to what conventionally known forms of stable oxides cerium has and what the oxidation states of these oxides are. One of ordinary skill in the art reading Subramanian would be directed to use stable oxides of cerium from the teaching of Subramanian that stable oxides are desired and that cerium oxides can be used (column 2, lines 35-40 and column 5,lines 35-45), and would be directed to determine what such stable oxides of cerium are. The Examiner also notes the discussion of the obviousness of this combination in the Board decision of August 24, 2006 at page 4, last paragraph.

Appellant further argues that there must be an expectation of success and that this requirement has not been addressed in the explanation of the rejection and that more than Examiner's argument is required here (see page 10 of the Appeal Brief). The Examiner has reviewed these arguments, however, the Examiner disagrees with appellant's position. The Examiner has provided that the use of CeO_2 would be suggested by the combination of Subramanian and Stoffer as discussed in the ***Grounds of Rejection*** above. As every process feature of the invention described by appellant is

provided, including the primary ceramic application of yttria stabilized zirconia and the application of CeO_2 (cerium oxide with cerium in the +4 valence state) on this zirconia, which thus provides the "sintering inhibitor region" (see paragraph [0012] and [0030] of the specification and the claims), an expectation of successfully performing the claimed process would be present. The Examiner also notes the discussion of the obviousness of this combination in the Board decision of August 24, 2006 at page 4, last paragraph through page 5, first full paragraph.

Appellant further argues that the prior art does not teach the claimed limitation at pages 10-12 of the Appeal Brief, first providing case law, and then arguing that Subramanian, at column 2, lines 35-40 discloses using C as a stable oxide, not as cerium alone, thus providing, when put into the formula CzOw that (CeO_2)zOw, would be used for example, rather than CeO_2. The Examiner disagrees. While Subramanian does not use the most clear language at column 2, lines 25-35, a reading of the reference as a whole clearly provides that what is intended is that CzOw is in the form of a stable oxide with C selected from a specific element, not an oxide. See the discussion at column 5, lines 35-45, where A, B and C are selected from various elements and specific rare earth elements that include cerium, not oxides or rare earth oxides. Furthermore, this is confirmed at column 2, lines 40-45 where a specific embodiment of the invention is described such that the "preferred precursor sheath material is a thin coating of alumina Al_2O_3 and the preferred base column material is yttria stabilized zirconia". In other words "the precursor sheath material" (CzOw) is described as Al_2O_3, such that

C=Al, z=2 and w=3. According to appellant's argument, the C itself would have to be Al_2O_3 such that CzOw provided (Al_2O_3)zOw, which is not what is specifically spelled out by the reference. The Examiner also notes the discussion in the Board decision of August 24, 2006, page 5, first full paragraph, where it is noted that the relevant teaching of Subramanian is not column 2, lines 25-40, but rather column 5, lines 34, et. seq.

Claims 13, 15

Appellant further argues at pages 12-13 of the Appeal Brief, that the Examiner has not provided that either reference has a teaching of excess oxygen vacancies or cerium in an oxidation state that removes oxygen vacancies. Appellant notes that the Examiner has provided that the use of CeO_2. . . would inherently remove oxygen vacancies because . . . because CeO_2 is a material that inherently provides such removal from yttria stabilized zirconia. Appellant argues that there is no such teaching in the art, and asks for a basis of this assertion of inherency as provided in MPEP 2112-2113, arguing that absent appellant's own discoveries, there would be no reason to combine the teaching of the two references. Appellant further argues that as discussed above, the use of a stable oxide of CzOw, where C=Ce is not provided by Subramanian.

The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. As discussed in the ***Grounds of Rejection*** above, the combination of references provides the suggestion of applying CeO_2 to the primary ceramic coating, which primary coating as taught by Subramanian can be yttria stabilized zirconia. Furthermore, the Examiner has noted that such a ytrria stabilized

zirconia coating inherently has oxygen vacancies. It is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes in paragraph [0012] that "When yttria is added to zirconia, it produces an excess of oxygen vacancies . . .". This same statement is noted in paragraph [0030] of the specification. These are not statements of possibilities, but rather of facts. As to the position of the Examiner that the provision of CeO_2 on the primary ceramic coating would provide a coating that would inherently remove oxygen vacancies, it is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes in paragraph [0012] that "The formation of CeO_2 with cerium in the +4 valence state acts to remove the oxygen vacancies . . ." Paragraph [0030] of the specification further notes that "The formation of CeO_2 or other +4 cerium oxide acts to remove the oxygen vacancies to thereby slow the diffusion of oxygen anions through the ceramic. . . The CeO_2 sintering inhibitor thereby slows and preferably prevents the sintering process. . .". These are not statements of possibilities, but rather of facts. While the cited prior art does not refers to the use of yttria stabilized zirconia (the primary ceramic) and CeO_2 (the sintering inhibitor) by reference to oxygen vacancies, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). Here, the references are combined for the reasons given in the ***Grounds of Rejection*** above, with one of ordinary skill in the art

being suggested by the statements in Subramanian to look to art to find named stable oxides of cerium. This reason to combine the art of Subramanian and Stoffer is not based on the teaching of applicant in the specification, but rather on what is in the references themselves. As to the use of a stable oxide of CzOw in Subramanian suggesting the use of $(CeO_2)zOw$ or $(Ce_2O_3)zOw$, the Examiner disagrees for the reasons discussed above in the main body of the discussion of **Ground 2**.

Claim 14

Appellant further argues, at page 13 of the Appeal Brief, that claim 14 requires providing the article as a nickel-base superalloy article which is mentioned by Subramanian, but Stoffer provides that the article is made of aluminum or aluminum alloy and if the teachings of Stoffer are otherwise adopted, the Stoffer teaching of the article is also adopted, and if the teachings of Subramanian are adopted over those of Stoffer, then that is per se hindsight reconstruction.

The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. As discussed in the ***Grounds of Rejection*** above, Subramanian is the primary reference and it teaches the use of a nickel-base superalloy article. A reading of Subramanian provides the suggestion to one of ordinary skill in the art, by the statements in Subramanian itself, to look to other prior art to find named stable oxides of cerium, so that one would know what oxides would desirably be used in the process. The Examiner has provided Stoffer as a teaching references that shows to one of skill in the art of coating what are specific stable oxides of cerium and what

their valence states would be. One of ordinary skill in the art, when modifying Subramanian by the suggestion to use stable oxides, would read both references as a whole, and would not believe that the substrate needs to be changed by reading Stoffer, but rather that Stoffer provides a factual basis of what are specific stable oxides of cerium. While Stoffer is considered as a whole, and uses a different substrate than that claimed, there is nothing in the reference to teach or indicate that the factual statements of the valences and examples of stable oxides would change based on the substrate used.

Claim 16

Appellant further argues, at pages 13-14 of the Appeal Brief, that claim 16 requires depositing a diffusion aluminide or aluminum-containing overlay bond coat, which is mentioned by Subramanian, but Stoffer provides that the coating is applied directly to the aluminum or aluminum alloy article and if the teachings of Stoffer are otherwise adopted, the Stoffer teaching of the article is also adopted, and if the teachings of Subramanian are adopted over those of Stoffer, then that is per se hindsight reconstruction.

The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. As discussed in the ***Grounds of Rejection*** above, Subramanian is the primary reference and it teaches the use of a bond coat as claimed. A reading of Subramanian provides the suggestion to one of ordinary skill in the art, by the statements in Subramanian itself, to look to other prior art to find named stable

oxides of cerium, so that one would know what oxides would desirably be used in the process. The Examiner has provided Stoffer as a teaching references that shows to one of skill in the art of coating what are specific stable oxides of cerium and what their valence states would be. One of ordinary skill in the art, when modifying Subramanian by the suggestion to use stable oxides, would read both references as a whole, and would not believe that the bond coat needs to not be present by reading Stoffer, but rather that Stoffer provides a factual basis of what are specific stable oxides of cerium. While Stoffer is considered as a whole, and does not use a bond coat, there is nothing in the reference to teach or indicate that the factual statements of the valences and examples of stable oxides would change based on the presence of absence of a bond coat.

Claim 17

Appellant further argues, at page 14 of the Appeal Brief, that claim 17 requires depositing a yttria stabilized zirconia as the primary ceramic coating, which is mentioned by Subramanian, but Stoffer provides that the coating is applied directly to the aluminum or aluminum alloy article and if the teachings of Stoffer are otherwise adopted, the Stoffer teaching of the article is also adopted, and if the teachings of Subramanian are adopted over those of Stoffer, then that is per se hindsight reconstruction.

The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. As discussed in the ***Grounds of Rejection*** above,

Subramanian is the primary reference and it teaches the use of a yttria stabilized zirconia primary coat as claimed. A reading of Subramanian provides the suggestion to one of ordinary skill in the art, by the statements in Subramanian itself, to look to other prior art to find named stable oxides of cerium, so that one would know what oxides would desirably be used in the process. The Examiner has provided Stoffer as a teaching references that shows to one of skill in the art of coating what are specific stable oxides of cerium and what their valence states would be. One of ordinary skill in the art, when modifying Subramanian by the suggestion to use stable oxides, would read both references as a whole, and would not believe that the yttria stabilized zirconia primary needs to not be present by reading Stoffer, but rather that Stoffer provides a factual basis of what are specific stable oxides of cerium. While Stoffer is considered as a whole, and does not use a yttria stabilized zirconia primary coat, there is nothing in the reference to teach or indicate that the factual statements of the valences and examples of stable oxides would change based on the presence of absence of a yttria stabilized zirconia primary coat.

Claim 18

The Examiner has withdrawn this rejection as to claim 18.

Claims 19-20

Appellant argues, at page 15 of the Appeal Brief, that the Examiner has not provided that either reference has a teaching of excess oxygen vacancies in the primary ceramic coating and while the explanation of the rejection asserts that this is inherent,

there is no basis provided for this alleged inherency. Appellant further argues that a sintering-inhbitor region that removes oxygen vacancies is not provided by the references, with no mention of cerium in an oxidation state that removes oxidation vacancies.

The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. As discussed in the ***Grounds of Rejection*** above, the combination of references provides the suggestion of applying CeO_2 to the primary ceramic coating, which primary coating as taught by Subramanian can be yttria stabilized zirconia. Furthermore, the Examiner has noted that such a yttria stabilized zirconia coating inherently has oxygen vacancies. It is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes in paragraph [0012] that "When yttria is added to zirconia, it produces an excess of oxygen vacancies . . .". This same statement is noted in paragraph [0030] of the specification. These are not statements of possibilities, but rather of facts. As to the position of the Examiner that the provision of CeO_2 on the primary ceramic coating would provide a coating that would inherently remove oxygen vacancies, it is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes in paragraph [0012] that "The formation of CeO_2 with cerium in the +4 valence state acts to remove the oxygen vacancies . . ." Paragraph [0030] of the specification further notes that "The formation of CeO_2 or other +4 cerium oxide acts to remove the oxygen vacancies to thereby slow the diffusion of

oxygen anions through the ceramic. . . The CeO_2 sintering inhibitor thereby slows and preferably prevents the sintering process. . .". These are not statements of possibilities, but rather of facts. While the cited prior art does not refers to the use of yttria stabilized zirconia (the primary ceramic) and CeO_2 (the sintering inhibitor) by reference to oxygen vacancies, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). Here, the references are combined for the reasons given in the ***Grounds of Rejection*** above, with one of ordinary skill in the art being suggested by the statements in Subramanian to look to art to find named stable oxides of cerium. This reason to combine the art of Subramanian and Stoffer is not based on the teaching of applicant in the specification, but rather on what is in the references themselves.

Claim 21

Appellant argues, at page 16 of the Appeal Brief, that claim 21 requires that the sintering-inhibitor region comprise cerium oxide with the cerium in the +4 valence state, and that that as discussed above, the use of a stable oxide of CzOw, where C=Ce is not provided by Subramanian.

The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. As to the use of a stable oxide of CzOw in

Subramanian suggesting the use of $(CeO_2)zOw$ or $(Ce_2O_3)zOw$, the Examiner disagrees for the reasons discussed above in the main body of the discussion of **Ground 2**.

Ground 3. The rejection of claims 1-5, 7, 9 and 13-21 using Villiger et al (US 2001/0003631) in view of Subramanian et al (US 6756082) (hereinafter Subramanian '082) and Liu Article

Appellant argues, at pages 16-18 of the Appeal Brief, that Villiger teaches closing the pores at surfaces with cerium acetate solution and that this inhibits corrosion of the sealed material, with no teaching of sintering inhibition or taking any action to inhibit sintering, while Subramanian teaches applying a CzOw coating such as (CeO2)zOw or (Ce2O3)zOw to a surface of a thermal barrier layer, without sealing the surface, for sintering inhibition. Appellant argues that these are different and inconsistent objectives, and different and inconsistent results. The Examiner notes these arguments, however, she disagrees with appellant's position. Initially, the Examiner understands that appellant was apparently reviewing the wrong Subramanian reference. Subramanian (US 6296945), used in the **Ground 2** rejection above, refers to CzOw. However, Subramanian '082 (US 6756082) which is the reference actually used in this rejection, does not refer to CzOw. Subramanian '082 teaches various features of thermal barrier coating systems as discussed in the ***Grounds of Rejection*** above, and discusses applying a sintering inhibition layer that is exemplified as aluminum oxide or yttricum

aluminum oxide (column 6, lines 50-65), and the Examiner has discussed the motivation for the combination of the references in the ***Grounds of Rejection*** above.

Appellant's further argues that the combination of references would be inappropriate because Villiger is directed to sealing off the capillary spaces, and the Examiner has cited Subramanian '082 to try and meet the claim language that the spaces are not filled by citing the columnar grain feature of Subramanian '082 and assuming that these spaces are too large to fill by Villiger (without any basis in fact), thus making a combination without sealing and closing pointless, since that would be the motivation for combining. Appellant further takes the position that the Examiner refers to partly filling the pores, but that this refers to Subramanian '082's coating, not Villiger's, with Villiger providing either sealing same pores so there is no gap, and not sealing large pores at all. The Examiner disagrees. The Examiner notes that Villiger specifically provides that a thermal barrier coating (paragraph [0002], to increase temperature protection) is to be treated and that this thermal barrier coating can be applied by thermal spraying of various ceramics including yttria and zirconia (paragraph [0017]). It is indicated that such a coating will have pores and fissures (paragraph [0014]). Villiger does teach that the treatment of the coating is to apply a "sealing medium" to seal the porous layers of thermal sprayed ceramic (paragraph [0004]). The sealing medium is applied to the layer surface and penetrates into the pores (capillary spaces) (paragraph [0019]). However, Villiger recognizes that such thermal sprayed ceramic coatings will conventionally also have large pores that cannot be sealed off (paragraph

[0032]). Villiger explicitly recognizes that when the ceramic layer is treated with the sealing medium, the large pores will not be sealed off, however, it is still beneficial to treat the ceramic layer because "... a coating which contains closed and relatively large pores can be used as a thermal protective layer with reduced thermal conductivity but higher corrosion resistance." (paragraph [0032] and claim 6 and 7). Therefore, it is clearly indicated to one of ordinary skill in the art by Villiger that thermal spray applied ceramic coatings conventionally have large and small pores and that the small pores can be sealed off by the sealant and that the large pores cannot be fully sealed, but that a ceramic layer that contains such larges pores can still be desirably treated by the sealant system to reduced thermal conductivity, but higher corrosion resistance, for example. Appellant argues that the large pores are not sealed at all, but from the application method described by Villiger, it is clear that at least some sealant will enter the pores and be in the pores, simply not close off the pores. As well, small pores would be sealed. Since ceramic layers with large pores can be desirably treated by the system of Villiger, it would be obvious to do so for the corrosion resistance benefits described by Villiger. Therefore, the suggestion to only "partly seal" the ceramic layer is provided by Villiger. As to the description in Subramanian '082 of the ceramic layer, this indicates that thermal barrier coating ceramic layers provided by the thermal spray method of plasma spraying conventionally provides a columnar grain surface (see column 4, lines 55-68 and figure 3). Moreover, Subramanian '082 shows that the pores and fissures in such a ceramic coating have a variety of sizes, from small to relatively large (figure 3).

Thus, one of ordinary skill in the art looking at the teaching of Villiger of relatively small and large pores from ceramic coatings applied by thermal spraying and the relatively small and large pores shown by Subramanian '082 would clearly expect that when using such columnar grain coatings that at least some gaps would be "large" pores as described by Villiger and that such columnar grain coatings would be the pore containing coating beneficially treated by the process of Villiger. Moreover, the Examiner notes these arguments appear to be directed to the claims that require the presence of air filled gaps after the cerium oxide is formed (which would be claim 1 and the claims depending from claim 1, but not claims 9 and 19 or the claims depending from them, as those claims do not require such gaps, and as to claim 13 and the claims dependent from claim 13, claim 13 requires "air-filled gaps between the facing surfaces of the columnar grains", however, as worded these can be present before the sintering-inhibitor region is formed, and therefore the claim does not prevent the gaps from being filled). Villiger and Liu Article provides for the application of material that would be cerium oxide with cerium in the +4 valence state required by the claims and that also provide the sintering-inhibitor region claimed, and therefore Subramanian '082 is not required for teaching the application of specific sintering-inhibitor material. Subramanian '082, rather, teaches features of the primary ceramic thermal barrier coating and other conventional features used with thermal barrier coatings. As to appellant's arguments with regard to the CzOw features of Subramanian, the Examiner

notes again that Subramanian '082, the reference used in this Ground of rejection does not discuss such a feature.

Claims 1-5, 7

Appellant argues, at pages 18-19 of the Appeal Brief, that neither reference has the teaching of applying the cerium oxide precursor compound that is not cerium oxide in a +4 oxidation state, and that the Examiner has cited, without support, that cerium acetate is not cerium oxide in a +4 oxidation state, which is not sufficient to meet the requirements of the 35 USC 103 rejection. The Examiner disagrees. Cerium acetate is a precursor material applied by Villiger that would then be oxidized (see paragraph [0027]). Cerium acetate would not, by definition, be "cerium oxide in a +4 oxidation state" since it is not "cerium oxide". Furthermore, the Examiner notes that appellant's own specification makes that factual statement that "carboxylates of cerium such as the acetate. . ." are operable cerium oxide precursors within the claimed invention, and thus would not be "cerium oxide in a +4 oxidation state" (paragraph [0029] of the specification).

As to appellant's arguments as to the closing of the pores by Villiger and the combination of Villiger and Subramanian, at pages 19-20 of the Appeal Brief, these arguments have been addressed in the main body of this **Ground 3** of rejection discussion above.

Claim 9

Appellant argues, at pages 20-21 of the Appeal Brief, that neither reference has the teaching of applying the cerium oxide precursor compound that is not cerium oxide in a +4 oxidation state, and that the Examiner has cited, without support, that cerium acetate is not cerium oxide in a +4 oxidation state, which is not sufficient to meet the requirements of the 35 USC 103 rejection. The Examiner disagrees. Cerium acetate is a precursor material applied by Villiger that would then be oxidized (see paragraph [0027]). Cerium acetate would not, by definition, be "cerium oxide in a +4 oxidation state" since it is not "cerium oxide". Furthermore, it is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification which makes that factual statement that "carboxylates of cerium such as the acetate. . ." are operable cerium oxide precursors within the claimed invention, and thus would not be "cerium oxide in a +4 oxidation state" (paragraph [0029] of the specification).

As to appellant's arguments with regard to the CzOw teachings of Subramanian '082, at page 21 of the Appeal Brief, the Examiner again notes that as discussed in the main body of this **Ground 3** of rejection above, the Subramanian '082 reference used in this **Ground 3** of rejection does not discuss such a feature.

<u>Claims 13-17</u>

Appellant further argues, at page 21 of the Appeal Brief, that the Examiner has not provided that either reference has a teaching of excess oxygen vacancies. Appellant notes that the Examiner referred to yttria stabilized zirconia which inherently has an excess of oxygen vacancies (the Examiner notes that the Examiner actally referred to

Villiger teaching "yttria with zirconia") at paragraph [0017], but argues that paragraph [0017] has no mention of oxygen vacancies either inherent or otherwise, and "inherency" is used because the prior art does not teach the claim limitation, only the present application discloses this limitation, and this is an attempt to use Applicant's own discovery and disclosure against them. The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. The Examiner has cited Villiger as teaching "yttria with zirconia", and the Examiner has noted that such coating inherently has oxygen vacancies. It is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes in paragraph [0012] that "When yttria is added to zirconia, it produces an excess of oxygen vacancies . . .". This same statement is noted in paragraph [0030] of the specification. These are not statements of possibilities, but rather of facts.

Appellant further agues, at page 22 of the Appeal Brief, that none of the reference teaches "cerium in an oxidation state that removes oxygen vacancies from the primary ceramic coating", and that the Examiner has noted that Villiger does not teach this feature and then did not mention the limitation again, and also refers to the paragraph bridging pages 9-10 of the Final Office Action as addressing this rejection as applied to claim 13. Then appellant argues that the Examiner took the position that the use of CeO_2 would inherently remove these oxygen vacancies. According to the appellant, this is without any basis, instead being argued inherently present. The Examiner has reviewed these arguments, however, the Examiner disagrees with appellant. First the

Examiner notes that pages 9-10 of the Final Rejection were a description of Subramanian '082. The motivation to combine the references was provided at pages 10-12 of the Final Rejection. Furthermore, in the rejection itself, as noted in the ***Grounds of Rejection*** above, the Examiner provided a description of what was missing in Villiger, and a specific discussion in the motivation statement as to why cerium in the claimed oxidation state is provided –

> It would further have been obvious to modify the process of Villiger in view of Subramanian '082 to select a precursor that provides CeO_2 as the formed oxide, which would provide that the cerium oxide precursor is such that the resulting cerium oxide has cerium in the +4 valence state as suggested by Liu Article with an expectation of desirable protective sealing results, because Villiger teaches to oxidize cerium acetate and to oxidize using oxygen from the surroundings and Liu Article teaches that it is well known that when cerium acetate is oxidized to provide cerium oxide, CeO_2 is formed, which would have cerium in a +4 oxidation state (as oxygen has a +2 valence state), and thus Villiger teaches that a cerium oxide precursor that results in cerium oxide with cerium in the +4 valence state can be desirably used. The use of CeO_2 would provide that the applied cerium oxide/sintering inhibitor region would inherently remove oxygen vacancies from the primary ceramic coating, because CeO_2 is a material that inherently provides such removal from yttria stabilized zirconia. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

As to CeO_2 inherently removing the oxygen vacancies, it is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes in paragraph [0012] that "The formation of CeO_2 with cerium in the +4 valence state acts to remove the oxygen vacancies . . ." Paragraph [0030] of the

specification further notes that "The formation of CeO_2 or other +4 cerium oxide acts to remove the oxygen vacancies to thereby slow the diffusion of oxygen anions through the ceramic. . . The CeO_2 sintering inhibitor thereby slows and preferably prevents the sintering process. . .". These are not statements of possibilities, but rather of facts. While the cited prior art does not refers to the use of yttria stabilized zirconia (the primary ceramic) and CeO_2 (the sintering inhibitor) by reference to oxygen vacancies, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). The primary ceramic coating having an excess of oxygen vacancies because yttria with zirconia was used, was addressed earlier in this section.

As to appellant's arguments with regard to the CzOw teachings of Subramanian '082, at page 22 of the Appeal Brief, the Examiner again notes that as discussed in the main body of this **Ground 3** of rejection above, the Subramanian '082 reference used in this **Ground 3** of rejection does not discuss such a feature.

<u>Claim 18</u>

Appellant argues, at pages 22-23 of the Appeal Brief, that neither reference has the teaching of applying the cerium oxide precursor compound that is not cerium oxide in a +4 oxidation state, and that the Examiner has cited, without support, that cerium acetate is not cerium oxide in a +4 oxidation state, which is not sufficient to meet the requirements of the 35 USC 103 rejection. The Examiner disagrees. Cerium acetate is a

precursor material applied by Villiger that would then be oxidized (see paragraph [0027]). Cerium acetate would not, by definition, be "cerium oxide in a +4 oxidation state" since it is not "cerium oxide". Furthermore, it is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification which makes that factual statement that "carboxylates of cerium such as the acetate. . ." are operable cerium oxide precursors within the claimed invention, and thus would not be "cerium oxide in a +4 oxidation state" (paragraph [0029] of the specification).

Claims 19-20

Appellant further argues, at page 23 of the Appeal Brief, that the Examiner has not provided that either reference has a teaching of excess oxygen vacancies. Appellant argues that the rejection refers to "inherency" but there is no basis for this alleged inherency. The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. The Examiner has cited Villiger as teaching "yttria with zirconia", and the Examiner has noted that such coating inherently has oxygen vacancies. It is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes in paragraph [0012] that "When yttria is added to zirconia, it produces an excess of oxygen vacancies . . .". This same statement is noted in paragraph [0030] of the specification. These are not statements of possibilities, but rather of facts.

As to the sintering inhibiting region as claimed, appellant argues, at page 23 of the Appeal Brief, that neither reference has such a teaching and there is no mention of

cerium in an oxidation state that removes oxygen vacancies from the primary ceramic coating. The Examiner disagrees. This issue was fully discussed as to why it is suggested in the discussion of claims 13-17 in this **Ground 3** of rejection above.

Claim 21

Appellant argues, at page 24 of the Appeal Brief, that as to the use of cerium oxide with cerium in the +4 valence state, that the teachings of Subramanian in view of Stoffer cannot have Ce in the +4 oxidation state. The Examiner notes however, that these are not the references used in this **Ground 3** of rejection, and therefore these arguments do not apply to this rejection.

Ground 4. The rejection of claims 6 and 11 using Villiger in view of Subramanian '082 and Liu Article and further in view of Ueda et al (US 567992)

Appellant argues, at pages 24-25 of the Appeal Brief, that Ueda is nonanalogous art. The Examiner disagrees. In response to applicant's argument that Ueda is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Ueda is reasonably pertinent to the problem of appellant of providing CeO_2 from a precursor. While Ueda is not specifically directed to appellant's problem of applying and treating thermal barrier coatings (Villiger and

Subramanian '082 are also concerned with applying and treating thermal barrier coatings), as taught by Villiger, salts of oxidizable metal such as cerium are desirably used a precursors for the treatment of thermal barrier coatings, with Villiger including cerium nitrate and cerium acetate as possible precursors, but not limited to such, which precursors are then to be oxidized to form the oxide of the metal precursors (see paragraph [0020], [0025] and [0027]). Thus, one of ordinary skill in the art, concerned with applying thermal barrier coatings and treating them to provide a further cerium oxide coating would know from the teaching of Villiger that it is known to apply precursors of cerium oxide to a thermal barrier coating and then oxidize that precursor to form cerium oxide. One of ordinary skill in the art would therefore find it pertinent to know what conventional precursors of cerium oxide that form cerium oxide on heating would be and would be directed to art providing such a teaching. In this case, Ueda is used as a teaching reference to show well known cerium compound that can be used as precursors to form cerium oxide include cerium nitrate, cerium acetate and ammonium cerium sulfate. While Ueda is not concerned with treatment of thermal barrier coatings, it provides a factual statement as to precursors and their oxidation ability that would apply and be pertinent to the problem of appellant.

Appellant further argues, at page 25 of the Appeal Brief, that there is no objective teaching for combining Villiger, Subramanian '082 and Liu Article for the reasons stated earlier in the **Ground 3** rejection. The Examiner disagrees, for the reasons stated in the discussion of **Ground 3** above, and notes the motivation statement provided in the

Grounds of Rejection above as to the obviousness of combining all the references. Appellant further argues, at page 25 of the Appeal Brief, that there is also no objective basis for combining Ueda with these references as it deals with abrasive particles, not thermal barrier coatings, and does not apply a coating to a surface, and further if the teachings of Ueda regarding $(NH_4)Ce(SO_4)_3$ (ammonium cerium sulfate) is adopted, then the teaching of mixing the $(NH_4)Ce(SO_4)_3$ with aluminum oxide and silicon oxide must also be adopted. The Examiner disagrees. As discussed in the ***Grounds of Rejection*** above and the paragraph above, Ueda has been provided as a teaching reference that shows to one of ordinary skill in the art of coating what are specific known metal oxide precursors of cerium oxide that form cerium oxide when heated and oxidized. One of ordinary skill in the art looking at the primary reference of Villiger, would read both references as a whole and not believe that the further use that Ueda provides for its formed cerium oxide is the only use that can ever be used for cerium oxide, but rather that Ueda provides a factual basis of what a specific metal oxide precursors for cerium oxide. While Ueda is considered as a whole and does not apply its cerium oxide precursors to a thermal barrier coating, there is nothing in the reference to teach or indicate that the factual statements as to possible precursors for cerium oxide would change based on the presence or absence of a thermal barrier coating.

Appellant further argues, at page 25 of the Appeal Brief, that there is no reasonable expectation of success for the reasons stated earlier in the **Ground 3**

rejection. The Examiner disagrees, and is of the position that the rejection is proper for the reasons stated in the discussion of **Ground 3** above and in the ***Grounds of Rejection***.

Claim 6

Appellant argues, at page 26 of the Appeal Brief, that none of the references teach depositing $(NH_4)Ce(SO_4)_3$ onto a surface as required by claim 6, and if the teaching of Ueda as to $(NH_4)Ce(SO_4)_3$ is adopted, then the teaching of mixing the $(NH_4)Ce(SO_4)_3$ with aluminum oxide and silicon oxide must also be adopted. The Examiner disagrees. While none of the references alone specifically teach the depositing of ammonium cerium sulfate ($(NH_4)Ce(SO_4)_3$) onto a primary ceramic coating as claimed, it is the combination of the references, as discussed in the ***Grounds of Rejection*** above and earlier in this section, that provides the suggestion to do so. The Examiner has also discussed previously in this section as to why the use of Ueda would not require that the $(NH_4)Ce(SO_4)_3$ must also be mixed with aluminum oxide and silicon oxide. Appellant seems to be arguing that any combination of references cannot lead to any changes from the process of the underlying references, which goes against the entire principle of 35 USC 103, which of course provides that the art would be "modified" by their combination.

Claim 11

Appellant argues, at page 26 of the Appeal Brief, that none of the references teach depositing $(NH_4)Ce(SO_4)_3$ onto a surface as required by claim 11, and if the teaching of Ueda as to $(NH_4)Ce(SO_4)_3$ is adopted, then the teaching of mixing the

$(NH_4)Ce(SO_4)_3$ with aluminum oxide and silicon oxide must also be adopted. The Examiner disagrees. While none of the references alone specifically teach the depositing of ammonium cerium sulfate ($(NH_4)Ce(SO_4)_3$) onto a primary ceramic coating as claimed, it is the combination of the references, as discussed in the ***Grounds of Rejection*** above and earlier in this section, that provides the suggestion to do so. The Examiner has also discussed previously in this section as to why the use of Ueda would not require that the $(NH_4)Ce(SO_4)_3$ must also be mixed with aluminum oxide and silicon oxide. Appellant seems to be arguing that any combination of references cannot lead to any changes from the process of the underlying references, which goes against the entire principle of 35 USC 103, which of course provides that the art would be "modified" by their combination.

Ground 5. The rejection of claim 10 using Villiger in view of Subramanian '082 and Liu Article and further in view of Taylor et al (US 5520516)

Appellant argues, at page 27 of the Appeal Brief, that claim 10 depends from claim 9, and incorporates its limitations, and that the combination of Villiger, Subramania '082 and Liu Article do not teach these limitations for the reasons stated above and that Taylor adds noting in this regard. The Examiner disagrees with this position, and remains of the position that the combination of the references teaches all the features of these claims for the reasons stated in **Ground 3** above, with Taylor providing the further features required by claim 10.

Ground 6. The rejection of claims 1-5, 7, 9 and 13-21 using Villiger et al (US 2001/0003631) in view of Taylor et al (US 5520516) and Liu Article

Appellant argues, at pages 27-28 of the Appeal Brief, that Villiger teaches closing the pores at surfaces with cerium acetate solution and that this inhibits corrosion of the sealed material, while Villiger teaches that closed and large pores can however not be sealed off, and thus Villiger's approach is inoperable if the pores are large. Furthermore, appellant argues, Taylor teaches making a microcracked layer and that the width is generally less then about 1 mil, preferably less than ½ mil, and in deciding whether there is an objective basis for combining the teachings, a key question is whether the microcracks in Taylor are "small", so that they are filled and sealed by the Villiger approach or "large" so that they are not filled and sealed and therefore the Villiger approach is inoperable. The problem, according to appellant, with combining the teachings is that Villiger teaches closing off and sealing pores, while the present claims recite "leaving air-filled gasps between the facing surfaces of the columnar grains", and if the pores cannot be sealed so that gaps are left between the columnar grains, as hypothesized by the explanation of the rejection for the structure of Taylor, then a person of ordinary skill in the art would have no motivation to even attempt to use Villiger's approach. The Examiner disagrees. The Examiner first notes that these arguments are directed to the claims that require the presence of air filled gaps after the cerium oxide is formed (which would be claim 1 and the claims depending from claim

1, but not claims 9 and 19 or the claims depending from them, as those claims do not require such gaps, and as to claim 13 and the claims dependent from claim 13, claim 13 requires "air-filled gaps between the facing surfaces of the columnar grains", however, as worded these can be present before the sintering-inhibitor region is formed, and therefore the claim does not prevent the gaps from being filled). As to the presence of "air-filled gaps", the Examiner notes that Villiger specifically provides that a thermal barrier coating (paragraph [0002], to increase temperature protection) is to be treated and that this thermal barrier coating can be applied by thermal spraying of various ceramics including yttria and zirconia (paragraph [0017]). It is indicated that such a coating will have pores and fissures (paragraph [0014]). Villiger does teach that the treatment of the coating is to apply a "sealing medium" to seal the porous layers of thermal sprayed ceramic (paragraph [0004]). The sealing medium is applied to the layer surface and penetrates into the pores (capillary spaces) (paragraph [0019]). However, Villiger recognizes that such thermal sprayed ceramic coatings will conventionally also have large pores that cannot be sealed off (paragraph [0032]). Villiger explicitly recognizes that when the ceramic layer is treated with the sealing medium, the large pores will not be sealed off, however, it is still beneficial to treat the ceramic layer coating because ". . . a coating which contains closed and relatively large pores can be used as a thermal protective layer with reduced thermal conductivity but higher corrosion resistance." (paragraph [0032] and claims 6 and 7). Therefore, it is clearly indicated to one of ordinary skill in the art by Villiger that thermal spray applied

ceramic coatings conventionally have large and small pores and that the small pores can be sealed off by the sealant and that the large pores cannot be fully sealed, but that a ceramic layer that contains such larges pores can still be desirably treated by the sealant system to get higher corrosion resistance. Appellant appears to argue that the large pores are not sealed at all and the invention of Villiger would then be inoperable, but from the application method described by Villiger, it is clear that at least some sealant will enter the pores and be in the pores, simply not close off the pores. As well, small pores would be sealed. Since ceramic layers with large pores can be desirably treated by the system of Villiger, it would be obvious to do so for the corrosion resistance benefits described by Villiger. Therefore, the suggestion to only "partly seal" the ceramic layer is provided by Villiger, leaving at least some air filled gaps (pores). As to the description in Taylor of the ceramic layer, this indicates that thermal barrier coating ceramic layers provided by the thermal spray method of plasma spraying conventionally provides a vertically cracked, or columnar surface (see column 4, lines 30-60) which would have a variety of sizes of generally less than 1 mil (column 4, line 15 through column 5, line 15, note the splat size). Thus, one of ordinary skill in the art looking at the teaching of Villiger of relatively small and large pores from ceramic coatings applied by thermal spraying and the variety of application conditions and results shown by Taylor would clearly expect that when using such columnar grain coatings that at least some gaps would be "large" pores as described by Villiger and that such columnar grain coatings would be pore containing coatings beneficially

treated by the process of Villiger. It would still be desirable to treat such a coating, because Villiger, as discussed above, indicates the benefits of doing so. The provision of the cerium oxide with the cerium in the +4 valence state is provided by the combination of Villiger and Liu Article as discussed in the ***Grounds of Rejection*** above.

<u>Claims 1-5, 7</u>

Appellant argues, at pages 28-29 of the Appeal Brief, that neither reference has the teaching of applying the cerium oxide precursor compound that is not cerium oxide in a +4 oxidation state, and that the Examiner has cited, without support, that cerium acetate is not cerium oxide in a +4 oxidation state, which is not sufficient to meet the requirements of the 35 USC 103 rejection. The Examiner disagrees. Cerium acetate is a precursor material applied by Villiger that would then be oxidized (see paragraph [0027]). Cerium acetate would not, by definition, be "cerium oxide in a +4 oxidation state" since it is not "cerium oxide". Furthermore, the Examiner notes that appellant's own specification makes that factual statement that "carboxylates of cerium such as the acetate. . ." are operable cerium oxide precursors within the claimed invention, and thus would not be "cerium oxide in a +4 oxidation state" (paragraph [0029] of the specification).

As to appellant's arguments as to the closing of the pores by Villiger and the combination of Villiger and Taylor, at pages 29-30 of the Appeal Brief, these arguments have been addressed in the main body of this **Ground 6** of rejection discussion above.

<u>Claim 9</u>

Appellant argues, at pages 30-31 of the Appeal Brief, that neither reference has the teaching of applying the cerium oxide precursor compound that is not cerium oxide in a +4 oxidation state, and that the Examiner has cited, without support, that cerium acetate is not cerium oxide in a +4 oxidation state, which is not sufficient to meet the requirements of the 35 USC 103 rejection. The Examiner disagrees. Cerium acetate is a precursor material applied by Villiger that would then be oxidized (see paragraph [0027]). Cerium acetate would not, by definition, be "cerium oxide in a +4 oxidation state" since it is not "cerium oxide". Furthermore, it is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification which makes that factual statement that "carboxylates of cerium such as the acetate. . ." are operable cerium oxide precursors within the claimed invention, and thus would not be "cerium oxide in a +4 oxidation state" (paragraph [0029] of the specification).

Claims 13-17

Appellant further argues, at page 31 of the Appeal Brief, that none of the references has a teaching of excess oxygen vacancies. Appellant notes that the Examiner referred to yttria stabilized zirconia which inherently has an excess of oxygen vacancies (the Examiner notes that the Examiner actually referred to Villiger teaching "yttria with zirconia") at paragraph [0017], but argues that paragraph [0017] has no mention of oxygen vacancies either inherent or otherwise, and "inherency" is used because the prior art does not teach the claim limitation, only the present application discloses this limitation, and this is an attempt to use Applicant's own discovery and

disclosure against them. The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. The Examiner has cited Villiger as teaching "yttria with zirconia", and the Examiner has noted that such coating inherently has oxygen vacancies. It is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes in paragraph [0012] that "When yttria is added to zirconia, it produces an excess of oxygen vacancies . . .". This same statement is noted in paragraph [0030] of the specification. These are not statements of possibilities, but rather of facts.

Appellant further argues at page 31 of the Appeal Brief, that none of the references teaches a sintering-inhibitor region at the surface, and none of the references mentions the inhibition of sintering at all. The Examiner disagrees with appellant's position. The Examiner, as noted in the ***Grounds of Rejection*** above, has noted that the suggested application of the CeO_2 would inherently provide the sintering-inhibitor region as claimed, because CeO_2 is material that inherently acts as such a sintering-inhibitor material. The reason why CeO_2 would be such a material is discussed fully in the paragraph below.

Appellant further agues, at page 32 of the Appeal Brief, that none of the references teaches "cerium in an oxidation state that removes oxygen vacancies from the primary ceramic coating", and that the Examiner has noted that Villiger does not teach this feature. Then appellant argues that the Examiner took the position that the use of CeO_2 would inherently remove these oxygen vacancies. According to the

appellant, this is without any basis, instead being argued inherently present. The Examiner has reviewed these arguments, however, the Examiner disagrees with appellant. In the rejection itself, as noted in the ***Grounds of Rejection*** above, the Examiner provided a description of what was missing in Villiger, and a specific discussion in the motivation statement as to why cerium in the claimed oxidation state is provided –

> it would further have been obvious to modify Villiger to provide that the ceramic thermal barrier coating is in the form of columnar grains with facing surfaces and that the coating acting as a sintering inhibitor material partially fills the pores or gaps between the columns as suggested by Taylor with an expectation of providing a desirably protective thermal barrier coating, because Villiger teaches that the thermal barrier coating material can be zirconia with yttria at, for example, 8% yttria and that the pores can be partially filled with a material that would be sintering inhibiting, and Taylor teaches that a desirable zirconia thermal barrier coating includes zirconia stabilized with 7-8% yttria and applied as columnar grains (vertical macrocracks) which would have facing surfaces forming pores. It would further have been obvious to modify the process of Villiger in view of Taylor to select a precursor that provides CeO_2 as the formed oxide, which would provide that the cerium oxide precursor is such that the resulting cerium oxide has cerium in the +4 valence state as suggested by Liu Article with an expectation of desirable protective sealing results, because Villiger teaches to oxidize cerium acetate and to oxidize using oxygen from the surroundings and Liu Article teaches that it is well known that when cerium acetate is oxidized to provide cerium oxide, CeO_2 is formed, which would have cerium in a +4 oxidation state (as oxygen has a +2 valence state), and thus Villiger teaches that a cerium oxide precursor that results in cerium oxide with cerium in the +4 valence state can be desirably used. The use of CeO_2 would provide that the applied cerium oxide/sintering inhibitor region would inherently remove oxygen vacancies from the primary ceramic coating, because CeO_2 is a material that inherently provides such removal from yttria stabilized zirconia. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot

> be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985)

As to CeO_2 inherently removing the oxygen vacancies, it is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes that "The formation of CeO_2 with cerium in the +4 valence state acts to remove the oxygen vacancies . . ." Paragraph [0030] of the specification further notes that "The formation of CeO_2 or other +4 cerium oxide acts to remove the oxygen vacancies to thereby slow the diffusion of oxygen anions through the ceramic. . . The CeO_2 sintering inhibitor thereby slows and preferably prevents the sintering process. . .". These are not statements of possibilities, but rather of facts. While the cited prior art does not refers to the use of yttria stabilized zirconia (the primary ceramic) and CeO_2 (the sintering inhibitor) by reference to oxygen vacancies, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). The primary ceramic coating having an excess of oxygen vacancies because yttria with zirconia was used, was addressed earlier in this section.

<u>Claim 18</u>

Appellant argues, at page 32 of the Appeal Brief, that none of the references has the teaching of applying the cerium oxide precursor compound that is not cerium oxide in a +4 oxidation state, and that the Examiner has cited, without support, that cerium

acetate is not cerium oxide in a +4 oxidation state, which is not sufficient to meet the requirements of the 35 USC 103 rejection. The Examiner disagrees. Cerium acetate is a precursor material applied by Villiger that would then be oxidized (see paragraph [0027]). Cerium acetate would not, by definition, be "cerium oxide in a +4 oxidation state" since it is not "cerium oxide". Furthermore, it is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification which makes that factual statement that "carboxylates of cerium such as the acetate. . ." are operable cerium oxide precursors within the claimed invention, and thus would not be "cerium oxide in a +4 oxidation state" (paragraph [0029] of the specification).

Claims 19-20

Appellant further argues, at pages 32-33 of the Appeal Brief, that none of the references has a teaching of excess oxygen vacancies. Appellant argues that the rejection refers to "inherency" but there is no basis for this alleged inherency. The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. The Examiner has cited Villiger as teaching "yttria with zirconia", and the Examiner has noted that such coating inherently has oxygen vacancies. It is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes in paragraph [0012] that "When yttria is added to zirconia, it produces an excess of oxygen vacancies . . .". This same statement is noted in paragraph [0030] of the specification. These are not statements of possibilities, but rather of facts.

As to the sintering inhibiting region as claimed, appellant argues, at page 33 of the Appeal Brief, that none of the references has such a teaching and there is no mention of cerium in an oxidation state that removes oxygen vacancies from the primary ceramic coating. The Examiner disagrees. This issue was fully discussed as to why it is suggested in the discussion of claims 13-17 in this **Ground 6** of rejection above.

Claim 21

Appellant argues, at page 33 of the Appeal Brief, that as to the use of cerium oxide with cerium in the +4 valence state, that none of the references teach that the sintering-inhibitor region comprises cerium oxide with cerium in the +4 valence state. The Examiner disagrees. This issue was fully discussed as to why it is suggested to provide a sintering-inhibitor region in the discussion of claims 13-17 in this **Ground 6** of rejection discussion above. As to the use of cerium oxide in the +4 valence state, the Examiner specifically provided, in the ***Grounds of Rejection*** above, as to why the use of Liu Article suggests that the cerium oxide formed by Villiger would be CeO_2, which would be cerium oxide in the +4 valence state. See the quotation from the rejection in the discussion of claims 13-17 in this **Ground 6** of rejection discussion above. The Examiner maintains her position as to this, and notes that appellant has provided no specific arguments against this position.

Ground 7. The rejection of claims 6 and 11 using Villiger in view of Taylor and Liu Article and further in view of Ueda et al (US 567992)

Appellant argues, at page 34 of the Appeal Brief, that Ueda is nonanalogous art for the reasons discussed with regard to **Ground 4**. The Examiner disagrees. In response to applicant's argument that Ueda is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Ueda is reasonably pertinent to the problem of appellant of providing CeO_2 from a precursor. While Ueda is not specifically directed to appellant's problem of applying and treating thermal barrier coatings (Villiger and Taylor are also concerned with applying and treating thermal barrier coatings), as taught by Villiger, salts of oxidizable metal such as cerium are desirably used a precursors for the treatment of thermal barrier coatings, with Villiger including cerium nitrate and cerium acetate as possible precursors, but not limited to such, which precursors are then to be oxidized to form the oxide of the metal precursors (see paragraph [0020], [0025] and [0027]). Thus, one of ordinary skill in the art, concerned with applying thermal barrier coatings and treating them to provide a further cerium oxide coating would know from the teaching of Villiger that it is known to apply precursors of cerium oxide to a thermal barrier coating and then oxidize that precursor to form cerium oxide. One of ordinary skill in the art would therefore find it pertinent to know what conventional precursors of cerium oxide that form cerium oxide on heating would be and would be directed to art providing such a teaching. In this

case, Ueda is used as a teaching reference to show well known cerium compound that can be used as precursors to form cerium oxide include cerium nitrate, cerium acetate and ammonium cerium sulfate. While Ueda is not concerned with treatment of thermal barrier coatings, it provides a factual statement as to precursors and their oxidation ability that would apply and be pertinent to the problem of appellant.

Appellant further argues, at page 34 of the Appeal Brief, that there is no objective basus for combining Villiger, Taylor and Liu Article for the reasons stated earlier in the **Ground 6** rejection. The Examiner disagrees, for the reasons stated in the discussion of **Ground 6** above and notes the motivation statement provided in the ***Grounds of Rejection*** above as to the obviousness of combining all the references. Appellant further argues, at page 34 of the Appeal Brief, that there is also no objective basis for combining Ueda with these references as it deals with abrasive particles, not thermal barrier coatings, and does not apply a coating to a surface, and further if the teachings of Ueda regarding $(NH_4)Ce(SO_4)_3$ (ammonium cerium sulfate) is adopted, then the teaching of mixing the $(NH_4)Ce(SO_4)_3$ with aluminum oxide and silicon oxide must also be adopted. The Examiner disagrees. As discussed in the ***Grounds of Rejection*** above and the paragraph above, Ueda has been provided as a teaching reference that shows to one of ordinary skill in the art of coating what are specific known metal oxide precursors of cerium oxide that form cerium oxide when heated and oxidized. One of ordinary skill in the art looking at the primary reference of Villiger, would read both references as a whole and not believe that the further use that Ueda provides for its

formed cerium oxide is the only use that can ever be used for cerium oxide, but rather that Ueda provides a factual basis of what a specific metal oxide precursors for cerium oxide. While Ueda is considered as a whole and does not apply its cerium oxide precursors to a thermal barrier coating, there is nothing in the reference to teach or indicate that the factual statements as to possible precursors for cerium oxide would change based on the presence or absence of a thermal barrier coating.

Appellant further argues, at page 34 of the Appeal Brief, that there is no reasonable expectation of success for the reasons stated earlier in the **Ground 3** (apparently meaning **Ground 6**) rejection. The Examiner disagrees, and is of the position that the rejection is proper for the reasons stated in the discussion of **Ground 3/Ground 6** above and in the ***Grounds of Rejection*** above.

Claim 6

Appellant argues, at page 35 of the Appeal Brief, that none of the references teach depositing $(NH_4)Ce(SO_4)_3$ onto a surface as required by claim 6, and if the teaching of Ueda as to $(NH_4)Ce(SO_4)_3$ is adopted, then the teaching of mixing the $(NH_4)Ce(SO_4)_3$ with aluminum oxide and silicon oxide must also be adopted. The Examiner disagrees. While none of the references alone specifically teach the depositing of ammonium cerium sulfate ($(NH_4)Ce(SO_4)_3$) onto a primary ceramic coating as claimed, it is the combination of the references, as discussed in the ***Grounds of Rejection*** above and earlier in this section, that provides the suggestion to do so. The Examiner has also discussed previously in this section as to why the use of Ueda would

not require that the $(NH_4)Ce(SO_4)_3$ must also be mixed with aluminum oxide and silicon oxide. Appellant seems to be arguing that any combination of references cannot lead to any changes from the process of the underlying references, which goes against the entire principle of 35 USC 103, which of course provides that the art would be "modified" by their combination.

Claim 11

Appellant argues, at page 35 of the Appeal Brief, that none of the references teach depositing $(NH_4)Ce(SO_4)_3$ onto a surface as required by claim 11, and if the teaching of Ueda as to $(NH_4)Ce(SO_4)_3$ is adopted, then the teaching of mixing the $(NH_4)Ce(SO_4)_3$ with aluminum oxide and silicon oxide must also be adopted. The Examiner disagrees. While none of the references alone specifically teach the depositing of ammonium cerium sulfate ($(NH_4)Ce(SO_4)_3$) onto a primary ceramic coating as claimed, it is the combination of the references, as discussed in the ***Grounds of Rejection*** above and earlier in this section, that provides the suggestion to do so. The Examiner has also discussed previously in this section as to why the use of Ueda would not require that the $(NH_4)Ce(SO_4)_3$ must also be mixed with aluminum oxide and silicon oxide. Appellant seems to be arguing that any combination of references cannot lead to any changes from the process of the underlying references, which goes against the entire principle of 35 USC 103, which of course provides that the art would be "modified" by their combination.

Ground 8. The rejection of claims 19-21 using Villiger in view of Vine et al (US 4861618) and Liu Article

Appellant argues, at page 36 of the Appeal Brief, that Villiger teaches closing the pores at surfaces with cerium acetate solution and that this inhibits corrosion of the sealed material, while Villiger teaches that closed and large pores can however not be sealed off, and thus Villiger's approach is inoperable if the pores are large. Furthermore, appellant argues, Vine has no teaching of pores, large or small, in a ceramic layer and no teaching of any need to close or seal pores in a ceramic layer, and thus there is no reason that one skilled in the art would apply the cerium acetate solution of Villiger to the article of Vine. The Examiner has reviewed these arguments, however, the Examiner disagrees with appellant's position. As to the closing or not closing of pores, Villiger teaches the suggested treatment of the ceramic coating and that this thermal barrier coating has pores to be treated. As worded in claim 19 there is no requirement that air gaps remain in the pores, etc. after coating. As to appellant's argument that the Vine does not contain references to pores, and therefore would not indicate the need to close or seal pores, appellant appears to be mistaken about the purpose of Vine. The primary reference to Villiger teaches the pores and suggested treatment of the ceramic coating. Vine is cited merely to suggest the desire to use of a bond coating system under a ceramic thermal barrier coating system. See the discussion in the ***Grounds of Rejection*** above. The cerium acetate solution is not being applied to the article of Vine, rather the article of the primary reference to Villiger is

being adapted to also have a bond coat system under the ceramic thermal barrier coating system for the beneficial reasons cited by Vine.

Appellant further argues, at page 36 of the Appeal Brief, that as there is no disclosure that Vine's material has small pores that could be closed and sealed by application of the solution of Villiger, the is no expectation of success in using process that closes and seals small pores. The Examiner has reviewed these arguments, however, the Examiner disagrees with appellant's position for the reasons given in the paragraph above.

Claims 19-20

Appellant further argues, at pages 36-37 of the Appeal Brief, that none of the references has a teaching of excess oxygen vacancies. Appellant argues that the rejection refers to "inherency" but there is no basis for this alleged inherency. The Examiner has reviewed appellant's arguments, however, the Examiner disagrees with appellant's positions. The Examiner has cited Villiger as teaching "yttria with zirconia", and the Examiner has noted that such coating inherently has oxygen vacancies. It is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes in paragraph [0012] that "When yttria is added to zirconia, it produces an excess of oxygen vacancies . . .". This same statement is noted in paragraph [0030] of the specification. These are not statements of possibilities, but rather of facts.

As to the sintering inhibiting region as claimed, appellant argues, at page 37 of the Appeal Brief, that none of the references has such a teaching and there is no mention of cerium in an oxidation state that removes oxygen vacancies from the primary ceramic coating. The Examiner disagrees. The Examiner provided, in the ***Grounds of Rejection*** above, that CeO_2 is suggested to be formed on the article and that this would inherently provide the claimed sintering inhibitor region that would remove oxygen vacancies as claimed. As to CeO_2 inherently removing the oxygen vacancies, it is the Examiner's position that appellant has noted and agreed to this position in appellant's own specification, which specifically notes at paragraph [0012] that "The formation of CeO_2 with cerium in the +4 valence state acts to remove the oxygen vacancies . . ." Paragraph [0030] of the specification further notes that "The formation of CeO_2 or other +4 cerium oxide acts to remove the oxygen vacancies to thereby slow the diffusion of oxygen anions through the ceramic... The CeO_2 sintering inhibitor thereby slows and preferably prevents the sintering process. . .". These are not statements of possibilities, but rather of facts. While the cited prior art does not refers to the use of yttria stabilized zirconia (the primary ceramic) and CeO_2 (the sintering inhibitor) by reference to oxygen vacancies, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). The primary ceramic coating having an

excess of oxygen vacancies because yttria with zirconia was used, was addressed in the paragraph above.

(11) Related Proceeding(s) Appendix

Copies of the court or Board decision(s) identified in the Related Appeals and Interferences section of this examiner's answer are provided in Appellant's Appeal Brief.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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